IPPAQ Optoelectronics Survey Results
April 5, 2001

Melanie Ott
Component Technologies and Radiation Effects Branch
NASA Goddard Space Flight Center
Melanie.ott@gsfc.nasa.gov

A survey of the NEPP participating NASA Centers was conducted to determine the greatest needs concerning the use of optoelectronic parts on space flight hardware. Several NEPP representatives formed a temporary committee to explore this issue as part of the IPPAQ task for optoelectronics. The optoelectronics IPPAQ committee met to discuss the priorities of current space flight project requirements for optoelectronic parts. The meeting was held in an effort to formulate the most important issues facing the design and development engineers at the various NASA centers. The attendees from this meeting were functioning as representatives of their respective NASA centers and current supported space flight projects. The list of technologies of greatest interest was compiled during this meeting. This list of technologies was sent out via email to all who did and did not attend on the mailing list. The group was asked to prioritize the list that had been originally collected as a result of the IPPAQ meeting. Presented here are the results of this survey.

Each participant was asked to numerically rank each technology on the list. Each participating member followed the instructions and used one of two methods for numerical assesment. These results were then averaged to formulate an overall NASA perspective. In the case of GSFC the results are further broken down into a radiation and general parts/packaging perspective since the number of members from GSFC was large. The following is a listing of the participating NASA centers and the corresponding representatives:

Dr. Margaret Tuma, GRC
Dr. Carl Magee, LaRC
Dr. Leonard Dorsky, JPL
Dr. Charles Barnes, JPL
Dr. Robert Reed, GSFC radiation
Dr. Cheryl Marshall, GSFC radiation
Dr. Paul Marshall, GSFC radiation
Jeannette Plante, GSFC
Harry Shawn, GSFC
Melanie Ott, GSFC

The general NEPP/NASA consensus, formulated from all data gathered is presented in Table 1. In Table 1, the number 1 represents the most significant technology and 12 the least significant of the technologies in this listing. The listing does represent the most significant technologies in the family of optoelectronics according to recent space flight requirements. Not all assessments were graded in the same fashion. However, the data as it arrived from each participant was easily converted for an overall assessment through averaging all inputs together and reassigning the final listing into a 1 to 12 number scale.

Table 1: Survey of all NASA centers on optoelectronic parts in order of priority.

Priority Ranking	Technology
1	Fiber optic cable
2	Optical modulators
3	LEDs
4	Fiber optic links
5	Pump laser diodes
6	Interconnection
7	Rare earth doped fiber
8	Focal plane arrays
9	CCDs
10	WDM components
11	Thermoelectric coolers
12	APDs

In summary, Table 1 contains the summary results of the survey factoring inputs from all NASA centers based on the perspectives of current space flight programs. It is important to note that of all technologies discussed in the group this listing represents the "hottest" topics among project concerns related to optoelectronics. So even when a technology appears at the bottom of the priority list it does not imply that this topic is not necessary for investigation, it simply places a perspective on the list as a whole.

The collected assessements were broken down into center responses and subject responses as mentioned previously. Table 2 contains those results.

Table 2: Technology vs. NASA center prioritized on a number scale

Technology vs. Centers	GRC	LaRC	JPL	GSFC	GSFC radiation	GSFC parts
Fiber optic cable	8	2	1	1	7	1
Optical modulators	2	2	7	2	5	2
LEDs	3	1	3	6	4	7
Fiber optic links	1	3	9	5	3	6
Pump laser diodes	6	1	11	3	9	3
Interconnection	11	2	2	7	10	5
Rare earth doped fiber	10	2	6	4	6	4
Focal plane arrays	12	1	4	8	2	9
CCDs	4	1	5	10	1	12
WDM components	5	3	10	9	8	8
Thermoelectric coolers	7	2	8	11	11	11
APDs	9	1	12	12	12	10

In Table 2 the same priority assignment numbers are used where 1 indicates highest priority and 12 indicates the lowest. In the case of LaRC the numbers are used to indicate high (1), med (2) or low (3) priority. The purpose for providing the GSFC information was for perspective and insight since the total center priority list is greatly affected by the greater GSFC membership.

The technology called “fiber links” actually consists of the parts that comprise a system involving communication through an optical fiber medium. Therefore, parts such as transceivers, detectors, laser diode and LED sources, Bragg gratings, modulators or any other components involved in a system that uses light propagated through an optical fiber can be considered as parts of a fiber link. The system as a whole is also implied. Although this entry in the listing is redundant with the more specific parts listed, it does include items not on the list and as a stand alone system is indeed a technology of great interest for usage in space flight.

The list included here is comprehensive of various issues regarding these particular technologies. In some cases such as with optical modulators, very little data has been gathered on the failure mechanisms and the technology is transforming at a fast pace. With other devices for example, fiber cabling, sources and detectors for fiber links the issues of packaging, radiation and the quality of the parts all become items for concern when considering their usage in a harsh environment. Therefore, each technology has more than a few issues associated with its proper usage and part selection and solving the combination of concerns in many cases is not trivial. A little more than half of these technologies listed are currently under investigation as part of the NEPP program or are proposals for the following year.